

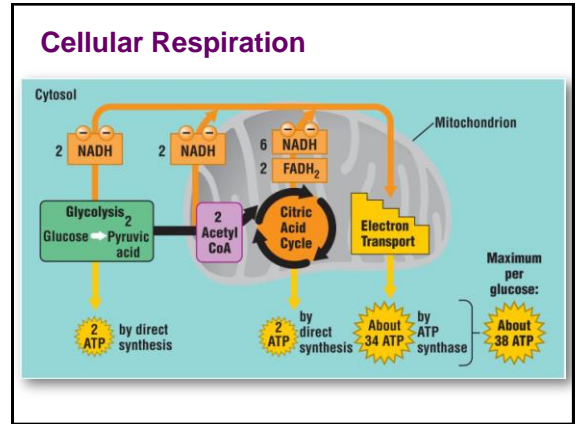


## Chapter 7

### Cellular Respiration: Other Metabolites & Control of Respiration

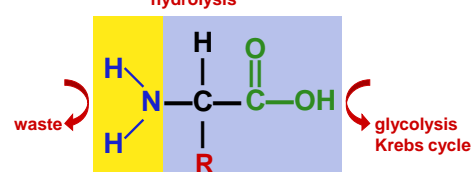


### Beyond glucose: Other carbohydrates

- Glycolysis accepts a wide range of carbohydrates fuels
  - ◆ polysaccharides → → → glucose  
hydrolysis
  - ex. starch, glycogen
  - ◆ other 6C sugars → → → glucose  
modified
  - ex. galactose, fructose

### Beyond glucose: Proteins

- proteins → → → → → amino acids  
hydrolysis

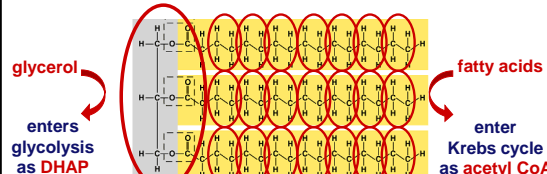


**amino group =**  
waste product  
excreted as  
ammonia, urea,  
or uric acid

**carbon skeleton =**  
enters glycolysis  
or Krebs cycle at  
different stages

### Beyond glucose: Fats

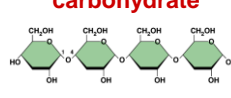
- Fats → → → → → glycerol & fatty acids  
hydrolysis
- ◆ glycerol (3C) → → → DHAP → → → glycolysis
- ◆ fatty acids → 2C acetyl → acetyl → Krebs cycle  
coA



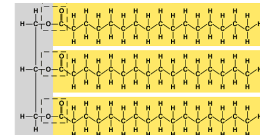
### Carbohydrates vs. Fats

- Fat generates 2x ATP vs. carbohydrate
- ◆ more C in gram of fat
- ◆ more O in gram of carbohydrate
  - so it's already partly oxidized

**carbohydrate**



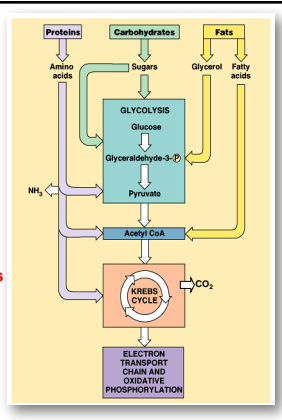
**fat**



Check the energy per gram listings on the Nutritional Fact sheet on all foods

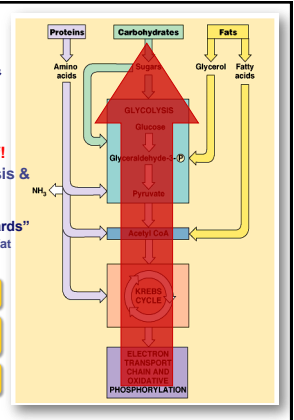
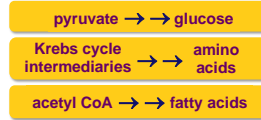
### Metabolism

- Coordination of digestion & synthesis
  - ♦ by regulating enzyme
- Digestion
  - ♦ digestion of carbohydrates, fats & proteins
    - all catabolized through same pathways
    - enter at different points
  - ♦ cell extracts energy from every source



### Metabolism

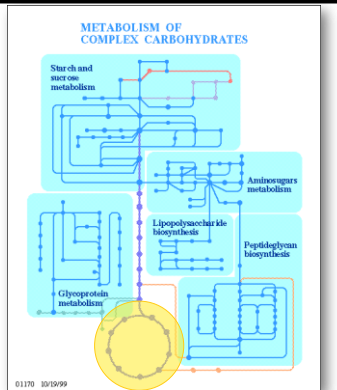
- Coordination of digestion & synthesis
  - ♦ by regulating enzymes
- Synthesis
  - ♦ enough energy? **build stuff!**
  - ♦ cell uses points in glycolysis & Krebs cycle as links to pathways for synthesis
    - run the pathways "backwards"
      - eat too much fuel, build fat



### Carbohydrate Metabolism

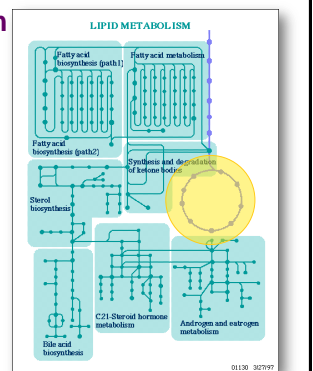
- The many steps on the "Carbo Line"

gluconeogenesis



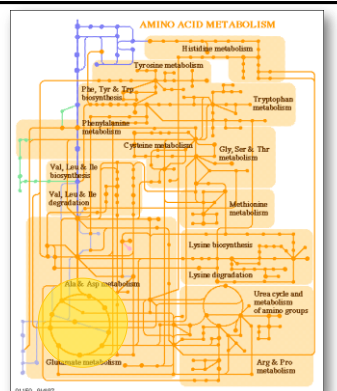
### Lipid Metabolism

- The many steps on the "Lipid Line"



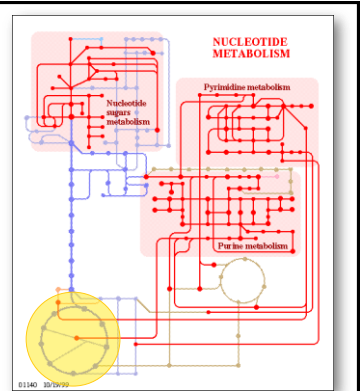
### Amino Acid Metabolism

- The many steps on the "AA Line"



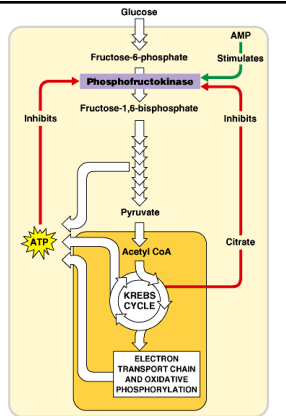
### Nucleotide Metabolism

- The many steps on the "GATC Line"



## Control of Respiration

### Feedback Control of Cellular Respiration



## Feedback Inhibition

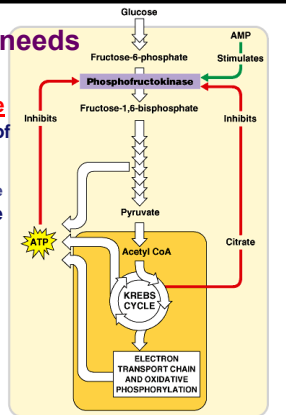
- Regulation & coordination of production
  - production is self-limiting
  - final product is inhibitor of earlier step
    - allosteric inhibitor of earlier enzyme
  - no unnecessary accumulation of product



G is an allosteric inhibitor of enzyme 1

## Respond to cell's needs

- Key points of control
  - phosphofructokinase**
    - allosteric regulation of enzyme
      - "can't turn back" step before splitting glucose
  - AMP & ADP stimulate
  - ATP inhibits
  - citrate inhibits

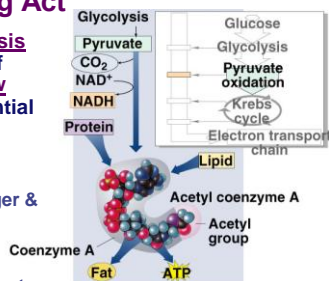


## A Metabolic Economy

- Basic principles of supply & demand regulate metabolic economy
  - balance the supply of raw materials with the products produced
  - these molecules become feedback regulators
    - they control enzymes at strategic points in glycolysis & Krebs cycle
      - AMP, ADP, ATP
        - regulation by final products & raw materials
    - levels of intermediates compounds in the pathways
      - regulation of earlier steps in pathways
    - levels of other bio-molecules in body
      - regulates rate of siphoning off to synthesis pathways

## It's a Balancing Act

- Balancing synthesis with availability of both energy & raw materials is essential for survival!
  - do it well & you survive longer
  - you survive longer & you have more offspring
  - you have more offspring & you get to "take over the world"



Acetyl CoA is central to both energy production & synthesis make ATP or store it as fat

# Any Questions??